

## CLAIMS:

What is claimed is:

1. An analyzer for monitoring parameters of a machine including machine vibration comprising:

- a. A user input interface for receiving and transmitting a user input,
- b. At least one analog input for receiving a raw analog signal having a magnitude,
- c. A conditioning circuit connected to the analog input for receiving and processing the raw analog signal and producing a conditioned analog signal, the conditioned analog signal being produced from the raw analog signal based on predetermined criteria, the predetermined criteria including an input limit which is satisfied when the raw analog signal satisfies the input limit,
- d. A data processor for receiving and processing the user input and controlling the analyzer based in part on the user input,
- e. An output for producing an output signal at least in part corresponding to the conditioned analog signal;
- f. The analog input including at least a tachometer input for receiving a raw tachometer signal having a magnitude and a plurality of pulses having a cycle time corresponding to a speed of the machine,
- g. The conditioning circuit including at least a qualifying circuit connected to the tachometer input for receiving and processing the raw tachometer signal and producing a qualified tachometer signal, the qualified tachometer signal being produced when the raw tachometer signal is qualified based on predetermined criteria, and
- h. The output for producing an output signal corresponding to the qualified tachometer signal.

2. The analyzer of claim 1, wherein the predetermined criteria include an amplitude criterion, the amplitude criterion being satisfied when the raw tachometer signal exceeds an amplitude threshold, the conditioning circuit

5 producing a partially qualified tachometer signal corresponding to that portion of the raw tachometer signal that meets the amplitude criterion.

3. The analyzer of claim 2, wherein the predetermined criteria include a time criterion, the time criterion being satisfied when the partially qualified tachometer signal has a cycle time higher than a predetermined time limit.
4. The analyzer of claim 2, further comprising a microprocessor that implements the time criterion and produces tachometer signals that are modified based on the time criterion.
5. The instrument of claim 1, further comprising:
  - a. A circuit producing a comparison signal having a magnitude representing one of the predetermined criteria; and
  - b. An adjustable discriminator for receiving the comparison signal and the raw tachometer signal, comparing the magnitudes of the two received signals, and transmitting a partially qualified tachometer signal if the raw tachometer signal magnitude is greater than the comparison signal magnitude.
6. An analyzer for monitoring parameters of a machine including machine vibration, comprising:
  - a. A user input interface for receiving and transmitting a user input,
  - b. At least one analog input for receiving a raw analog signal having a magnitude,
  - c. A conditioning circuit connected to the analog input for receiving and processing the raw analog signal and producing a conditioned analog signal, the conditioned analog signal being produced from the raw analog signal based on predetermined criteria, the predetermined criteria including an input limit which is satisfied when the raw analog signal is below the input limit, the conditioning circuit having a selectable attenuator circuit for attenuating the raw analog signal when the input limit is exceeded,
  - d. A data processor for receiving and processing the user input and controlling the analyzer based in part on the user input,

implementing the predetermined criteria, controlling the selectable attenuator circuit, and performing analysis of the conditioned analog signal,

- e. An output for producing an output signal at least in part corresponding to the conditioned analog signal.

7. The analyzer of claim 6, wherein:

- a. The conditioning circuit includes a memory storing a preset gain and a variable gain amplifier circuit for amplifying signals based on the preset gain,
- b. The data processor includes a data processor memory,
- c. The user input includes a route that is stored in the data processor memory, the route identifying a plurality of machines and a preset gain for each machine,
- d. The data processor sets the gain of the variable gain amplifier circuit based on the preset gains stored in the memory.

8. The analyzer of claim 6, further comprising:

- a. A second analog input for receiving a second raw analog signal having a second magnitude, and
- b. A second conditioning circuit connected to the second analog input for receiving and processing the second raw analog signal and producing a second conditioned analog signal based on a second predetermined criteria, the second predetermined criteria including a second input limit which is satisfied when the second raw analog signal is below the input limit, the second conditioning circuit having a second selectable attenuator circuit for attenuating the second raw analog signal when the second input limit is exceeded,
- c. The data processor implementing the second predetermined criteria, controlling the second selectable attenuation circuit, and performing analysis of the second conditioned analog signal,

- 15 d. The output producing the output signal corresponding to at least one of the conditioned analog signal and the second conditioned analog signal.
9. The analyzer of claim 6, further comprising:
- a. A second analog input for receiving a second raw analog signal having a second magnitude,
- 5 b. A second conditioning circuit connected to the second analog input for receiving and processing the second raw analog signal and producing a second conditioned analog signal based on a second predetermined criteria, the second predetermined criteria including a second input limit which is satisfied when the second raw analog signal is below the input limit, the second conditioning circuit
- 10 having a second selectable attenuator circuit for attenuating the second raw analog signal when the second input limit is exceeded, and
- c. A summing circuit for receiving the conditioned analog signal and the second conditioned analog signal, producing a summation signal, the summation signal corresponding to the addition of the conditioned analog signal and the second conditioned analog signal, and transmitting the summation signal,
- 15 d. The data processor implementing the second predetermined criteria, controlling the second selectable attenuation circuit, and performing analysis of the second conditioned analog signal,
- 20 e. The output producing the output signal corresponding to at least one of the conditioned analog signal and the second conditioned analog signal.
10. The analyzer of claim 6, further comprising:
- a. A tachometer input for receiving a raw tachometer signal having a magnitude and a plurality of pulses having a cycle time corresponding to a speed of a machine and

- 5                   b.       A qualifying circuit connected to the tachometer input for receiving and processing the raw tachometer signal and producing a qualified tachometer signal, the qualified tachometer signal being produced when the raw tachometer signal is qualified based on a tachometer predetermined criteria, and
- 10                  c.       The output producing the output signal based on the qualified tachometer signal and the conditioned analog signal.
11. An analyzer for monitoring parameters of a machine including machine vibration comprising:
- 5                   a.       A user input interface for receiving and transmitting a user input,
- b.       At least one analog input for receiving a raw analog signal having a magnitude,
- c.       A conditioning circuit connected to the analog input for receiving and processing the raw analog signal and producing a conditioned analog signal, the conditioned analog signal being produced when the raw analog signal is conditioned based on predetermined criteria, the predetermined criteria including a machine amplitude criterion, the machine amplitude criterion being part of the user input and corresponding to a predetermined amplifier gain, the predetermined amplifier gain corresponding to the machine and being stored in a memory,
- 10                  d.       A data processor for receiving and processing the user input and controlling the analyzer based in part on the user input, implementing the predetermined criteria, selecting and implementing the predetermined amplifier gain based on the user input, and performing analysis of the conditioned analog signal, and
- 15                  e.       An output for producing an output signal corresponding to at least the conditioned analog signal.
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12. The analyzer of claim 11, further comprising:

- a. A second analog input for receiving a second raw analog signal having a second magnitude, and
- b. A second conditioning circuit connected to the second analog input for receiving and processing the second raw analog signal and producing a second conditioned analog signal based on a second predetermined criteria, the second predetermined criteria including a second machine amplitude criterion, the second machine amplitude criterion being part of the user input and corresponding to a second predetermined amplifier gain, the second predetermined amplifier gain corresponding to the machine and being stored in the memory,
- c. The data processor selecting and implementing the second predetermined amplifier gain based on the user input, and performing analysis of the second conditioned signal, and
- d. The output producing the output signal corresponding to at least one of the conditioned analog signal and the second conditioned analog signal.

13. The analyzer of claim 11 further comprising:

- a. A second analog input for receiving a second raw analog signal having a second magnitude,
- b. A second conditioning circuit connected to the second analog input for receiving and processing the second raw analog signal and producing a second conditioned analog signal based on a second predetermined criteria, the second predetermined criteria including a second machine amplitude criterion, the second machine amplitude criterion being part of the user input and corresponding to a second predetermined amplifier gain, the second predetermined amplifier gain corresponding to the machine and being stored in the memory, and

- 15 c. A summing circuit for receiving the conditioned analog signal and the second conditioned analog signal, producing a summation signal, the summation signal corresponding to the addition of the conditioned analog signal and the second conditioned analog signal, and transmitting the summation signal,
- 20 d. The data processor selecting and implementing the second predetermined amplifier gain based on the user input, and performing analysis of the second conditioned signal, and
- e. The output producing the output signal corresponding to at least one of the conditioned analog signal and the second conditioned analog signal.
14. The analyzer of claim 11 further comprising:
- 5 a. A tachometer input for receiving a raw tachometer signal having a magnitude and a plurality of pulses having a cycle time corresponding to a speed of a machine and
- b. A qualifying circuit connected to the tachometer input for receiving and processing the raw tachometer signal and producing a qualified tachometer signal, the qualified tachometer signal being produced when the raw tachometer signal is qualified based on a tachometer predetermined criteria, wherein:
- 10 c. The output produces the output signal based on at least one of the qualified tachometer signal and the conditioned analog signal.
15. The analyzer of claim 11, further comprising a housing having a user input interface having a plurality of buttons for receiving and transmitting the user input, the housing having a left gripping surface and a right gripping surface situated such that at least some of the buttons are thumb accessible while the analyzer is held with palms of a user engaging the left and right gripping surfaces.
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16. An analyzer for monitoring a machine comprising:

- a. A user input interface for receiving and transmitting a user input,
- b. A first analog input for receiving a first raw analog signal having a first magnitude,
- 5 c. A second analog input for receiving a second raw analog signal having a second magnitude,
- d. A first conditioning circuit connected to the first and second analog inputs for receiving and processing the first and second raw analog signals and producing a first conditioned analog signal, the first  
10 conditioned analog signal being produced from at least one of the first and second raw analog signals based on a first predetermined criteria, the first predetermined criteria including a first machine amplitude criterion, the first machine amplitude criterion being part of the user input and corresponding to a predetermined first channel amplifier gain, the predetermined first channel amplifier gain being stored in a memory,
- 15 e. A second conditioning circuit connected to the first and second analog inputs for receiving and processing the first and second raw analog signals and producing a second conditioned analog signal, the second conditioned analog signal being produced from at least one of the first and second raw analog signals based on a second predetermined criteria, the second predetermined criteria including the second machine amplitude criterion, the second machine amplitude criterion being part of the user input and corresponding  
20 to a predetermined second channel amplifier gain, the predetermined second channel amplifier gain being stored in the memory,
- 25 f. A data processor for receiving and processing the user input and controlling the analyzer based in part on the user input, implementing the predetermined criteria, which includes, selecting  
30 and implementing the predetermined first channel amplifier gain



and the predetermined second channel amplifier gain, and  
performing analysis based on the first and second conditioned  
analog signals, and

35 g. An output for producing an output signal corresponding to at least one of  
the first and second conditioned analog signals.

17. The analyzer of claim 16 further comprising a summing circuit for receiving  
the first conditioned analog signal and the second conditioned analog  
signal, producing a summation signal, the summation signal corresponding  
to the addition of the first conditioned analog signal and the second  
5 conditioned analog signal, and transmitting the summation signal.

18. The analyzer of claim 16 further comprising:

a. A tachometer input for receiving a raw tachometer signal having a  
magnitude and a plurality of pulses having a cycle time  
corresponding to a speed of a machine and

5 b. A qualifying circuit connected to the tachometer input for receiving and  
processing the raw tachometer signal and producing a qualified  
tachometer signal, the qualified tachometer signal being produced  
when the raw tachometer signal is qualified based on a tachometer  
predetermined criteria, wherein

10 c. The output produces the output signal further based on the qualified  
tachometer signal.

19. The analyzer of claim 16, further comprising a housing having a user input  
interface having a plurality of buttons for receiving and transmitting the  
user input, the housing having a left gripping surface and a right gripping  
surface situated such that at least some of the buttons are thumb accessible  
5 while the analyzer is held with palms of a user engaging the left and right  
gripping surfaces.

20. An analyzer for monitoring a machine comprising:

a. A user input interface for receiving and transmitting a user input,

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- b. A first analog input for receiving a first raw analog signal having a first magnitude,
- c. A second analog input for receiving a second raw analog signal having a second magnitude,
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- d. A first conditioning circuit connected to the first and second analog inputs for receiving and processing at least one of the first and second raw analog signals and producing a first conditioned analog signal, the first conditioned analog signal being produced from at least one of the first and second raw analog signals based on a first predetermined criteria,
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- e. A second conditioning circuit connected to the first and second analog inputs for receiving and processing at least one of the first and second raw analog signals and producing a second conditioned analog signal, the second conditioned analog signal being produced from at least one of the first and second raw analog signals based on a second predetermined criteria,
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- f. A summing circuit for receiving the first and second conditioned signals, producing a summation signal, the summation signal corresponding to the addition of the first and second conditioned signals, and transmitting the summation signal,
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- g. A data processor for receiving and processing the user input and controlling the analyzer based in part on the user input, implementing the predetermined criteria, which includes receiving and interpreting the user input and based on the user input, and performing analysis of the summation signal, and
- h. An output for producing an output signal corresponding to at least the summation signal.
21. The analyzer of claim 20, further comprising:
- a. A tachometer input for receiving a raw tachometer signal having a magnitude and a plurality of pulses having a cycle time corresponding to a speed of a machine and

- 5                   b.       A qualifying circuit connected to the tachometer input for receiving and processing the raw tachometer signal and producing a qualified tachometer signal, the qualified tachometer signal being produced when the raw tachometer signal is qualified based on a tachometer predetermined criteria, wherein
- 10                   c.       The output produces the output signal further based on the qualified tachometer signal.
22. The analyzer of claim 20, further comprising a housing having a user input interface having a plurality of buttons for receiving and transmitting the user input, the housing having a left gripping surface and a right gripping surface situated such that at least some of the buttons are thumb accessible
- 5                   while the analyzer is held with palms of a user engaging the left and right gripping surfaces.